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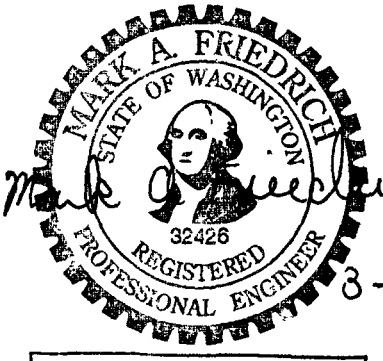

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History Sheet

Rev	Date	Reason for revision	Revised by
0	29 October 2002	Issued for permitting use	N McAdams
1	04 December 2003	Major revision, issued for permitting use	A Coulam
2	25 MARCH 2004	Issued for permitting use	A Coulam

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Acronyms and Abbreviations

Reference the piping and instrumentation diagrams (P&IDs) symbols and legend sheets as listed in the Applicable Documents section, for acronyms and abbreviations used in the figures.

AI	analog input
HEME	high efficiency mist eliminator
HLW	high level waste
HOP	melter offgas treatment process system
ITS	important to safety
LAH	level alarm high
LAHH	level alarm high high
LI	level indicator
LSH	level switch high
LSHH	level switch high high
LT	level transmitter
P&ID	piping and instrumentation diagram
PDAH	pressure differential alarm high
PDSH	pressure differential switch high
PVV	process vessel vent extraction system
RFD	reverse flow diverter
RLD	radioactive liquid waste disposal system
SBS	submerged bed scrubber
VSL	vessel
WESP	wet electrostatic precipitator
WTP	Hanford Tank Waste Treatment and Immobilization Plant

Glossary

Batch control	This term refers to control activities and control functions that provide an ordered set of processing activities to complete a batch process.
Batch process	A batch process leads to the production of a finite quantity of material by subjecting quantities of input material to an ordered set of processing activities over a finite period using one or more pieces of equipment.
Control system	This term refers to electronic processors that perform regulatory and logic control functions necessary for normal operation of the plant.
Exception handling	This term refers to those functions that deal with plant or process contingencies and other events that occur outside the normal or desired behavior of batch control.
High level	This term refers to a notification in the control system that is activated when the high level setpoint of the vessel has been reached.
High-high level	This term refers to a notification in the control system that is activated when the high-high level setpoint of the vessel has been reached.
Interlock	Predetermined system equipment connections so that action of one part of the system affects the action of another part of the system.
Low level	This term refers to a notification in the control system that is activated when the low level setpoint of the vessel has been reached.
Low-low level	This term refers to a notification in the control system that is activated when the low-low level setpoint of the vessel has been reached.

1 Introduction

This document describes the instrument control logic for dangerous waste vessels and ancillary equipment associated with the high-level waste (HLW) facility melter offgas treatment process (HOP) and process vessel vent extraction (PVV) systems as they pertain to the dangerous waste permit.

2 Applicable Documents

24590-WTP-M6-50-P0001, *P&ID Symbols and Legend Sheet 1 of 6*

24590-WTP-M6-50-P0002, *P&ID Symbols and Legend Sheet 2 of 6*

24590-WTP-M6-50-P0003, *P&ID Symbols and Legend Sheet 3 of 6*

24590-WTP-M6-50-P0004, *P&ID Symbols and Legend Sheet 4 of 6*

24590-WTP-M6-50-P0005, *P&ID Symbols and Legend Sheet 5 of 6*

24590-WTP-M6-50-P0006, *P&ID Symbols and Legend Sheet 6 of 6*

24590-HLW-M6-HOP-P0001, *P&ID-HLW Melter Offgas System Melter 1 Primary Offgas Scrubber*

24590-HLW-M6-HOP-P0002, *P&ID-HLW Melter Offgas System Melter 1 Primary Offgas WESP*

24590-HLW-M6-HOP-P0004, *P&ID-HLW Melter 1 Offgas Fluidic Air Rack HOP-RK-00025 (Q)*

24590-HLW-M6-HOP-P0006, *P&ID-HLW Melter Offgas System Melter 1 Primary Offgas Scrubber (Q) Condensate Vessel*

24590-HLW-M6-HOP-P0009, *P&ID-HLW Melter Offgas System Melter 1 Primary Offgas HEME*

24590-HLW-M6-HOP-P0010, *P&ID-HLW Melter Offgas System Melter 1 Primary Offgas HEPA Filters*

24590-HLW-M6-HOP-P20001, *P&ID-HLW Melter Offgas System Melter 2 Primary Offgas Scrubber*

24590-HLW-M6-HOP-P20002, *P&ID-HLW Melter Offgas System Melter 2 Primary Offgas WESP*

24590-HLW-M6-HOP-P20004, *P&ID-HLW Melter 2 Offgas Fluidic Air Rack HOP-RK-00048*

24590-HLW-M6-HOP-P20006, *P&ID-HLW Melter Offgas System Melter 2 Primary Offgas Scrubber Condensate Vessel*

24590-HLW-M6-HOP-P20009, *P&ID-HLW Melter Offgas System Melter 2 Primary Offgas HEME*

24590-HLW-M6-HOP-P20010, *P&ID-HLW Melter Offgas System Melter 2 Primary Offgas HEPA Filters*

24590-HLW-M6-PVV-P0001, *P&ID-HLW Process Vessel Vent Extraction System*

24590-HLW-M6-PVV-P20001, *P&ID-HLW Melter 2 Process Vessel Vent Extraction System*

24590-HLW-3YD-HOP-00001, *Systems Description for HLW Melter Offgas Treatment Process and Process Vessel Vent Extraction (HOP and PVV Systems)*

3 Description

The HLW HOP system plant items and ancillary equipment included in the dangerous waste permit are the following:

- HOP-SCB-00001 melter 1 submerged bed scrubber (SBS)
- HOP-SCB-00002 melter 2 submerged bed scrubber (SBS)
- HOP-VSL-00903 SBS condensate receiver vessel
- HOP-VSL-00904 melter 2 SBS condensate receiver vessel
- HOP-WESP-00001 melter 1 wet electrostatic precipitator (WESP)
- HOP-WESP-00002 melter 2 wet electrostatic precipitator (WESP)
- HOP-HEME-00001A melter 1 high efficiency mist eliminator (HEME)
- HOP-HEME-00001B melter 1 high efficiency mist eliminator (HEME)
- HOP-HEME-00002A melter 2 high efficiency mist eliminator (HEME)
- HOP-HEME-00002B melter 2 high efficiency mist eliminator (HEME)
- HOP-HEPA-00001A primary offgas HEPA filter
- HOP-HEPA-00002A primary offgas HEPA filter
- HOP-HEPA-00001B primary offgas HEPA filter
- HOP-HEPA-00002B primary offgas HEPA filter
- HOP-HEPA-00007A primary offgas HEPA filter, melter 2
- HOP-HEPA-00008A primary offgas HEPA filter, melter 2
- HOP-HEPA-00007B primary offgas HEPA filter, melter 2
- HOP-HEPA-00008B primary offgas HEPA filter, melter 2

The HLW PVV system does not contain any plant items or ancillary equipment included in the dangerous waste permit.

3.1 Melter 1 and 2 Submerged Bed Scrubbers (SBS)

The offgas from the HLW melters with film cooler and pressure control air is transferred via the primary offgas jumpers for further cooling and treatment in the submerged bed scrubbers (SBS) (HOP-SCB-00001 and HOP-SCB-00002). Each SBS removes particulates and cools the offgas to a desired discharge temperature by quenching the offgas with a solution and transferring the heat out using cooling coils and cooling jacket. The SBS levels are controlled by overflows into the SBS condensate receiver vessels (HOP-VSL-00903 and HOP-VSL-00904). There is redundant safety system level detection within the SBSs so that high-high liquid levels can be detected and the corresponding melter feed, reverse flow diverters (RFDs) in the SBS condensate receiver vessel and all controlled feeds into the SBS can be terminated. The scrubbed offgas discharges through the top of the SBSs for further treatment. Agitation

in the SBSs is maintained by solution jets powered by RFDs located in the SBS condensate receiver vessels. The agitation maintains the solids in the SBSs tank bottom in suspension so that solid slurry can be periodically removed by air jet activated siphon lines that draw slurry through the suction square to the acidic waste vessel (RLD-VSL-00007). Condensate is circulated between the SBS and the SBS condensate receiver vessel by pumping the solution using the RFDs.

The SBS liquid levels are maintained at nominal levels by fixed overflows to the SBS condensate receiver vessels. Condensate and particulates are removed from the systems by regular operational batch transfers from the SBSs to the acidic waste vessel (RLD-VSL-00007). Transfers maintain the SBS condensate receiver vessels within the acceptable operating range. When the operator initiates the transfer-out sequence, the control system will verify that instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The control system alarms or notifies the operator upon reaching the high, high-high, low, or low-low liquid levels.

When the levels are no longer within the normal operating range, interlocks in the programmable protection system overrides operation to control high-high liquid level conditions. Figure 1 shows the interlocks for the important to safety (ITS) level instruments in Table 1, which are associated with the SBSs.

3.2 Melter 1 and 2 SBS Condensate Receiver Vessels

The SBS condensate receiver vessels (HOP-VSL-00903 and HOP-VSL-00904) receive the condensate overflows from the SBSs, drainage from the wet electrostatic precipitators (WESP), and drainage from the high-efficiency mist eliminators (HEME). To help minimize the buildup of solids in the bottom of the SBSs, solution jets powered by RFDs in the SBS condensate receiver vessels are used to agitate the solution at the bottom of the SBSs. The agitation maintains the solids in the tank bottoms suspended so that they can be periodically removed by air jet activated siphon lines that draw slurry through the suction square in the SBSs to the acidic waste vessel (RLD-VSL-00007). Condensate is continuously circulated between the SBS condensate receiver vessels and the SBSs with the RFDs. Like the SBSs, there is redundant safety system level detection within the SBS condensate receiver vessels so that high-high liquid levels can be detected and the corresponding melter feed, water sprays to the WESP and HEME and all controlled feeds into the SBS condensate receiver vessel can be terminated. Because the SBSs operate at a constant level, the condensate builds up in the SBS condensate receiver vessels. The operator will initiate a liquid waste transfer from the SBS to the acidic waste vessel (RLD-VSL-00007) to maintain the SBS condensate receiver vessel within the acceptable operating range. The control system alarms or notifies the operator upon reaching the high, high-high, low or low-low liquid levels.

When the levels are no longer within the normal operating range, interlocks in the programmable protection system overrides operation to control high-high liquid level conditions. Figure 2 shows the interlocks for the ITS level instruments in Table 2, which are associated with the SBS condensate receiver vessels.

3.3 Melter 1 and 2 Wet Electrostatic Precipitators (WESP)

The SBSs offgas are routed to the corresponding WESPs (HOP-WESP-00001 and HOP-WESP-00002) for removal of aerosols and particulates down to a submicron size. The WESPs house vertical tubes, which act as positive electrodes. Each of these tubes also has a single negatively charged electrode, which runs down the centerline. The strong electric field, generated by the discharge electrode, generates

electrons that apply a negative charge to the offgas particles (corona effect). The negatively charged particles are then attracted to the positively charged tube walls. The collected particles are partially washed from the tube wall by entrained condensate that also collects on the inner tube wall. The solids are periodically washed from the tubes using water sprays from above the tubes. The water and collected particulates drains into the SBS condensate receiver vessels.

The WESPs will not be expected to have liquid level accumulation during normal operations. Figure 3 shows the indication for the level instruments in Table 3, which are associated with the WESPs. If liquid starts to accumulate in the WESPs during normal operations, the liquid level indication will alert the operator.

3.4 Melter 1 and 2 High Efficiency Mist Eliminators (HEME)

The purpose of the HEMEs (HOP-HEME-00001A, HOP-HEME-00001B, HOP-HEME-00002A, and HOP-HEME-00002B) is to further remove aerosols from the HLW melter offgas and the vessel ventilation air, and to reduce the solids-loading rate on the HEPA filters. As the offgas passes through the HEMEs, the liquid droplets and other aerosols in the offgas interact and adhere to the filaments by surface tension. The droplets agglomerate and eventually acquire enough mass to gravity flow to the bottom of the unit and drain into the SBS condensate receiver vessels. As the condensate flows down through the filter bed, a washing action is generated that will help wash and dissolve collected solids from the filter elements.

The HEMEs will not be expected to have liquid level accumulation during normal operations. Figure 4 shows the indication for the level instruments in Table 4, which are associated with the HEMEs. The liquid level indication will alert the operator that liquid is accumulating in the HEMEs.

3.5 Melter 1 and 2 High Efficiency Particulate Air (HEPA) Filters

The purpose of the high efficiency particulate air (HEPA) filters is to provide high efficiency submicron particulate removal. The HEPA filters will be periodically tested for particulate removal efficiency to validate performance. Figure 5 shows the indication for the pressure differential instruments in Table 5, which are associated with the HEPA filters.

3.6 Process Vessel Vent Extraction (PVV) System

The process vessel vent (PVV) system provides a vacuum on connected tanks relative to the tanks surroundings. The header is connected in the melter cave to the primary offgas system between the WESP and HEME, which provides the vacuum source. There is no figure or table associated with this system.

Table 1 Associated ITS Instruments for Melter 1 and 2 Submerged Bed Scrubbers (SBS)

Instrument Number	Associated Vessel	Description
HOP-LT-0104	HOP-SCB-00001	Safety control level
HOP-LT-0130	HOP-SCB-00001	Redundant safety control level
HOP-LT-2104	HOP-SCB-00002	Safety control level
HOP-LT-2130	HOP-SCB-00002	Redundant safety control level

Table 2 Associated ITS Instruments for Melter 1 and 2 SBS Condensate Receiver Vessels

Instrument Number	Associated Vessel	Description
HOP-LT-0110	HOP-VSL-00903	Safety control level
HOP-LT-0136	HOP-VSL-00903	Redundant safety control level
HOP-LT-2110	HOP-VSL-00904	Safety control level
HOP-LT-2136	HOP-VSL-00904	Redundant safety control level

Table 3 Associated Instruments for Melter 1 and 2 Wet Electrostatic Precipitators (WESP)

Instrument Number	Associated Vessel	Description
HOP-LT-0208	HOP-WESP-00001	Level
HOP-LT-2208	HOP-WESP-00002	Level

Table 4 Associated Instruments for Melter 1 and 2 High Efficiency Mist Eliminators (HEME)

Instrument Number	Associated Vessel	Description
HOP-LT-0216	HOP-HEME-00001A	Level
HOP-LT-0229	HOP-HEME-00001B	Level
HOP-LT-2216	HOP-HEME-00002A	Level
HOP-LT-2229	HOP-HEME-00002B	Level

Table 5 Associated Instruments for Melter 1 and 2 High Efficiency Particulate Air (HEPA) Filters

Instrument Number	Associated Vessel	Description
HOP-PDT-0222	HOP-HEPA-00001A	Pressure differential
HOP-PDT-0223	HOP-HEPA-00002A	Pressure differential
HOP-PDT-0235	HOP-HEPA-00001B	Pressure differential
HOP-PDT-0236	HOP-HEPA-00002B	Pressure differential
HOP-PDT-2222	HOP-HEPA-00007A	Pressure differential
HOP-PDT-2223	HOP-HEPA-00008A	Pressure differential

HOP-PDT-2235	HOP-HEPA-00007B	Pressure differential
HOP-PDT-2236	HOP-HEPA-00008B	Pressure differential

Figure 1 **Typical ITS Level Measurement For Melter 1 And 2 Submerged Bed Scrubbers**

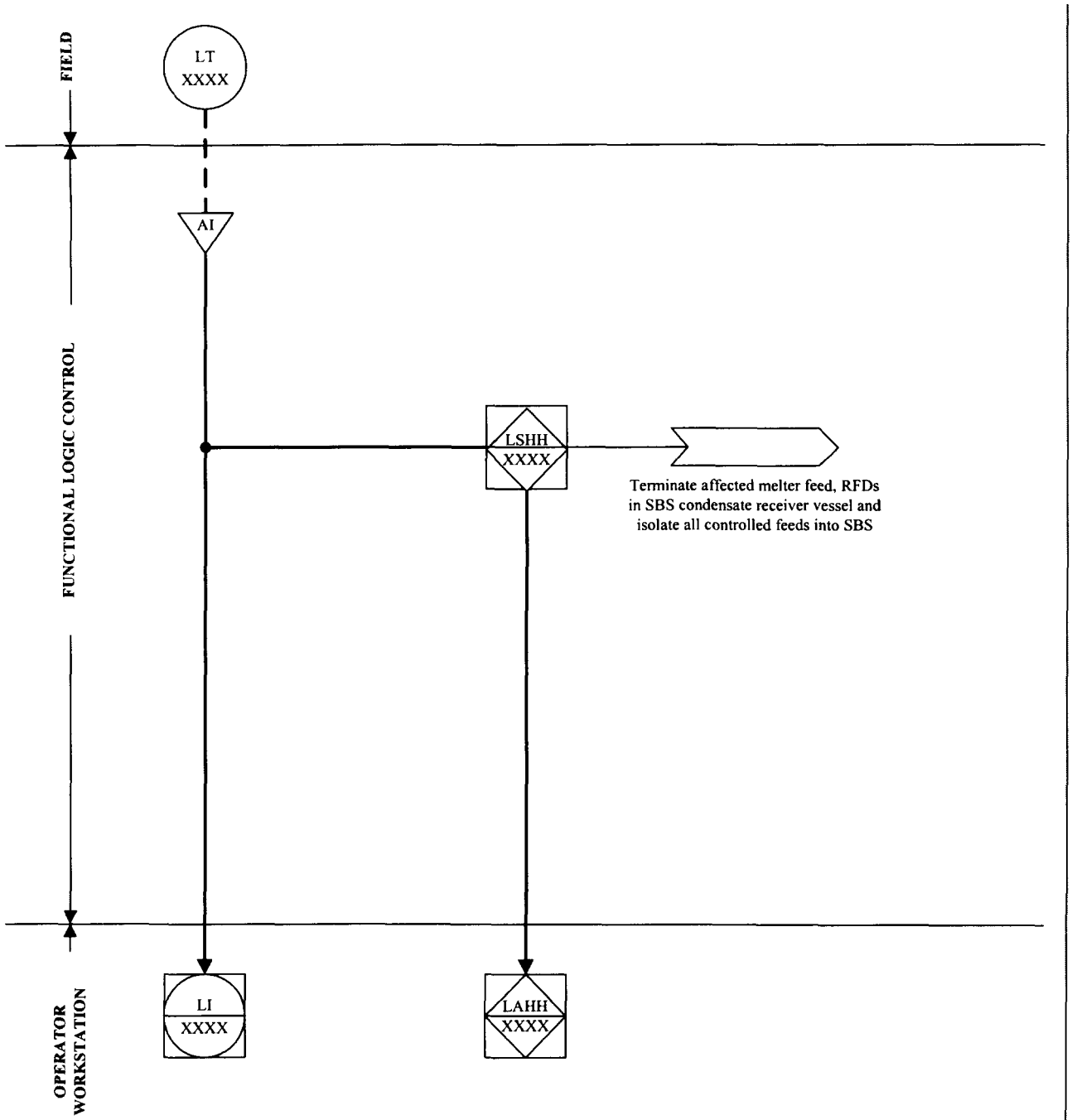

Figure 2 **Typical ITS Level Measurement For Melter 1 And 2 SBS Condensate Receiver Vessels**

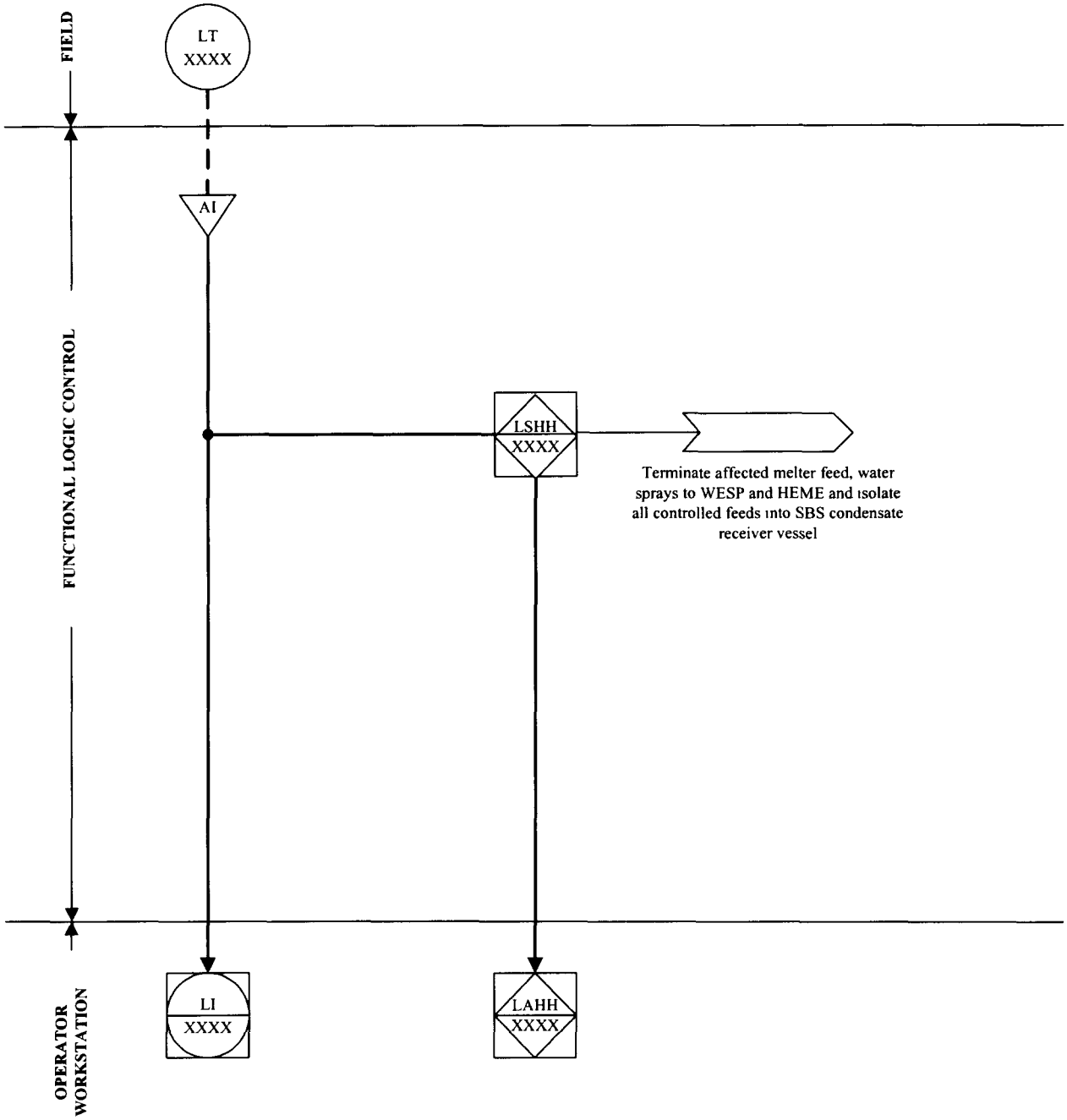

Figure 3 **Typical Level Measurement For Melter 1 And 2 Wet Electrostatic Precipitators (WESP)**

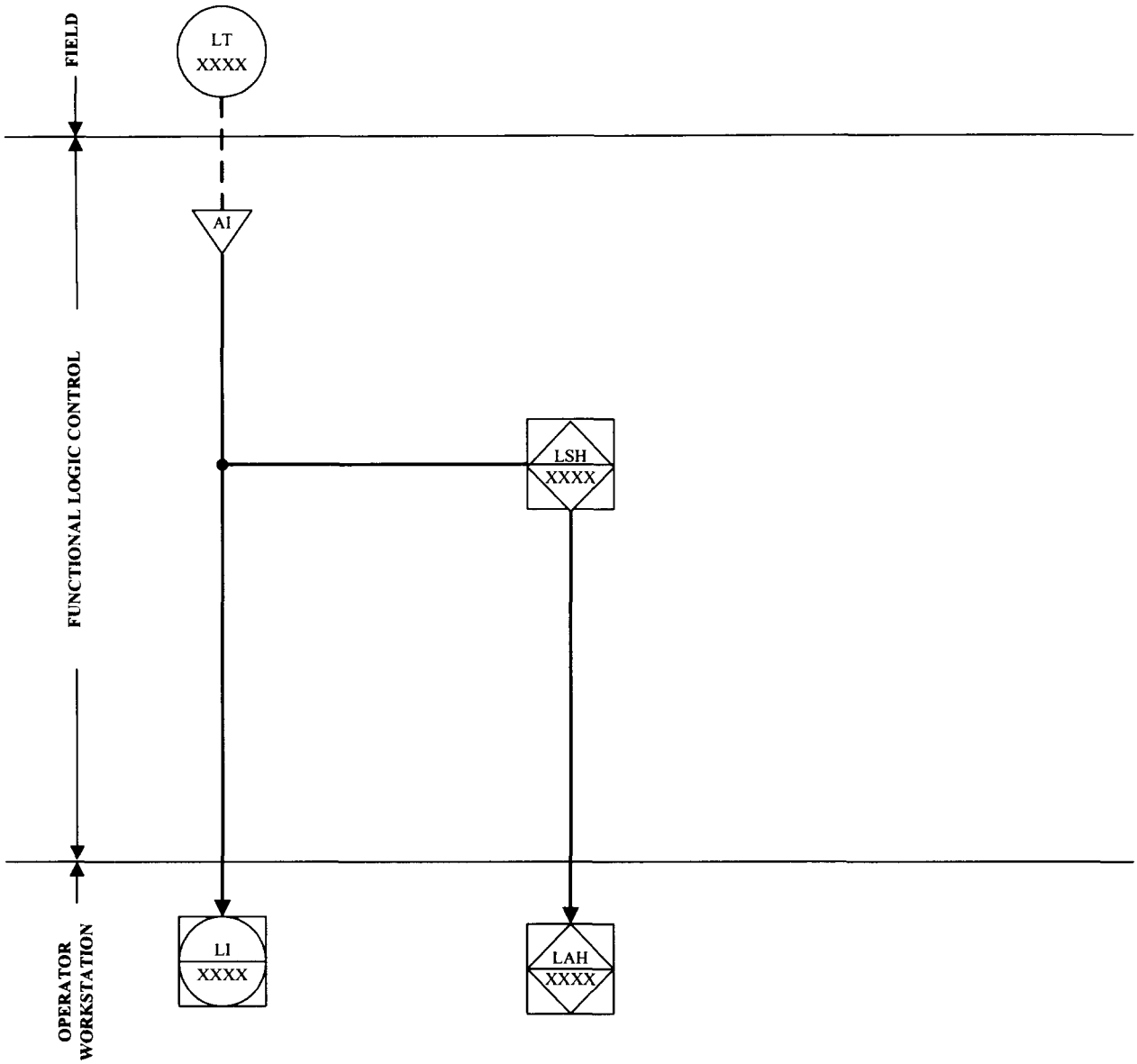

Figure 4 **Typical Level Measurement For Melter 1 And 2 High Efficiency Mist Eliminators (HEME)**

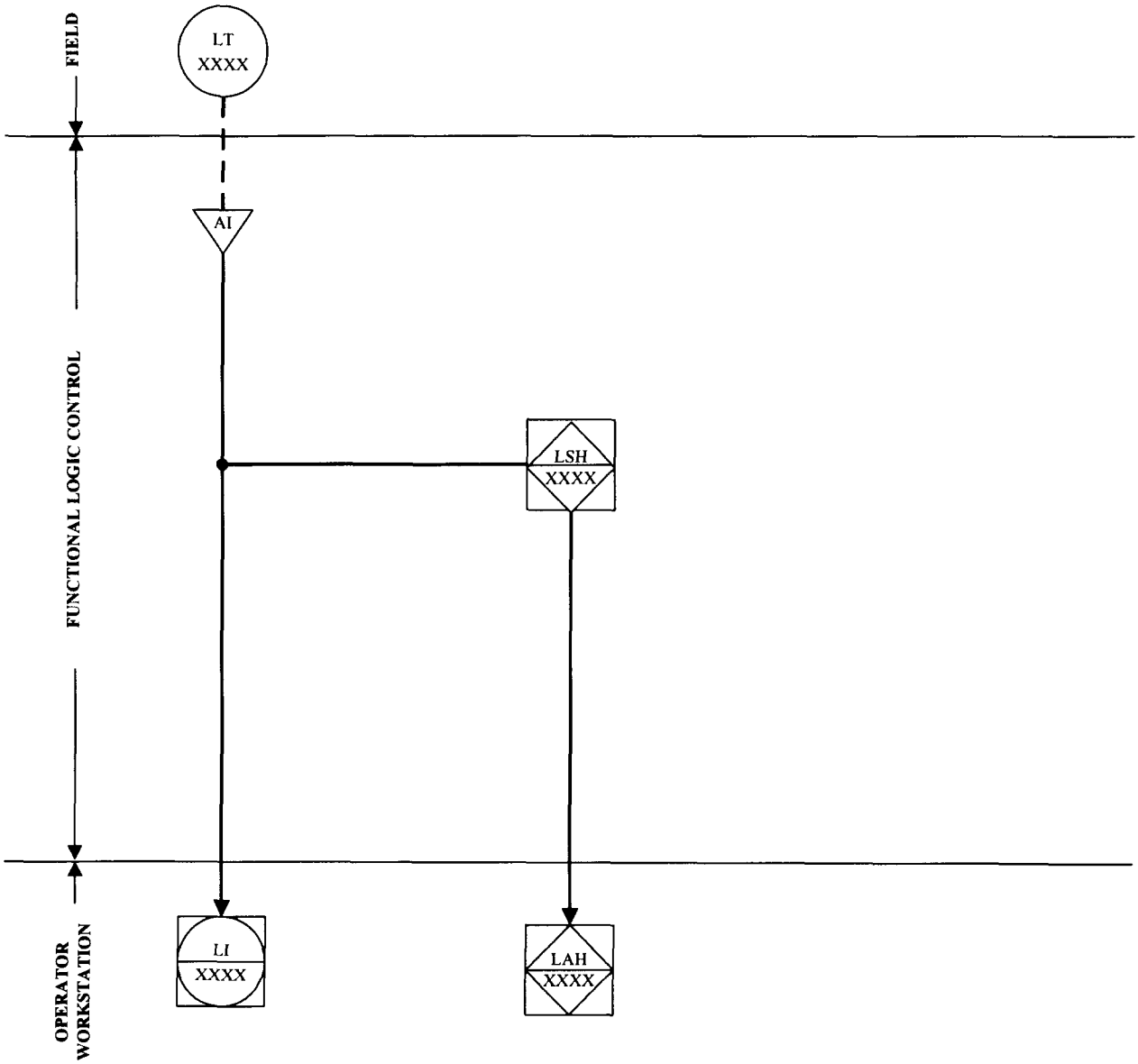

Figure 5 **Typical Pressure Differential Measurement For Melter 1 And 2 High Efficiency Particulate Air (HEPA) Filters**